Dredging Research

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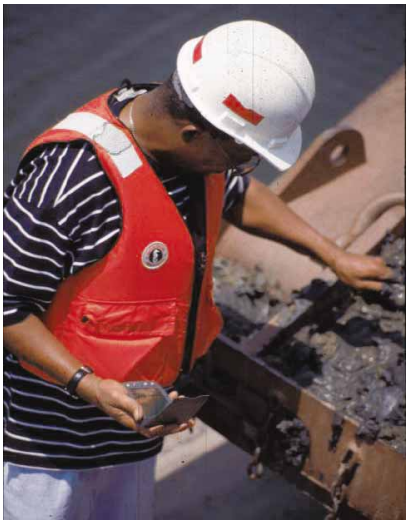
Automated inspection tool "Silent Inspector" undergoes field testing

by James Rosati, U.S. Army Engineer Waterways Experiment Station

Concerns about dredging operations, especially the placement of material and its impact on natural resources, have long been expressed by state, local and federal agencies, and environmental groups concerned in the dredging process. Dredging and placement of dredged material, especially contaminated sediments, is therefore a politically and environmentally sensitive issue. Inspectors for the Corps of Engineers closely monitor dredging activities performed under contract for quality control and performance. However, effective automated monitoring systems on all dredges working on Corps projects could provide useful, accurate, and unbiased information to all parties involved in the dredging and placement process. That information is important in verifying compliance with project specifications and environmental constraints. The Dredging Operations and Environmental Research (DOER) Program addresses the need for automated inspection methods in its Instrumentation Focus Area.

Today's dredging projects are increasingly complex, requiring

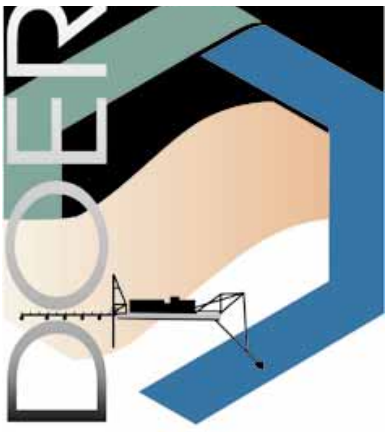


sophisticated planning. Measured dredge data can show the actual levels of success of dredging plans. Automation of data collection and management efforts could help to maximize capacity and useful life of disposal areas. Automation could help with the following:

- Comparing actual dredging results with estimated results to improve tracking of project progress and estimating methods.
- Using measured dredge data to improve preproject decisions, including selection of dredge plant, the quality and quantity of preproject geotechnical data, estimated dredging cycle times, and project duration.
- Monitoring dredge progress to assure compliance with dredging plans by reducing dredging beyond specified requirements (producing excess material for disposal sites) and documenting contractor attempts to meet the minimum required channel dimensions.

The DOER Silent Inspector (SI) aims to meet the challenges by

- **Providing environmental surveillance.** In response to the concern of environmental agencies about the impact of dredging on aquatic organisms or biota, dredge monitoring is useful to assure that dredgers



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are working in the most environmentally safe manner possible. Dredge monitoring can verify compliance with permit terms that specify dredging methods and restrict dredging areas, working times, and disposal locations.

- **Reducing claims.** In the case of contract dredging, contemporaneous records of the activity of a dredge throughout the life of a project can show changes in dredge performance and assist in determining their causes without resorting to the claims process. In any case, more factual data will be available to support the disposition and resolution of claims that do occur.
- **Standardizing contractor requirements.** The Corps of Engineers is working with state and other federal agencies to gain acceptance of SI standards for monitoring dredging operations, since inconsistent requirements increase compliance cost. Corps contractors will be able to move between Corps Districts without changing their monitoring equipment or software to meet standard requirements. Projects with nonstandard requirements can be accommodated as well.

The goals outlined cannot be realized unless the SI is widely adopted within the Corps and its contract dredging industry partners. To reach this end, a Process Action Team (PAT) with both Corps and industry participation has been formed. This team recommends standards in data acquisition, data transfer, and quality assurances for the SI. The PAT has recommended conducting demonstration projects to refine the SI followed by implementing field-proven quality assurance and quality control measures.

Field testing the SI

Mobile District personnel wanted to increase contractor production performance for rental hopper dredges working in Mobile Bay and reduce the need for contracted inspectors. Based on this need, a DOER-developed SI was field tested in a hopper dredge operation there.

The bid documents included SI hopper specifications. A rental contract was awarded to B+B Dredging Company using the dredge *Columbus*. As required by the SI specifications, the contractor submitted a Dredge Plant Instrumentation Plan. This plan documents the contractor's instrumentation and contains the information needed by the Corps to conduct a dredge inspection, assuring that the contractor is reporting valid data. Personnel from the Coastal and Hydraulics and the Information Technology Laboratories, WES, performed this dredge inspection and found no significant problems. Subsequently, WES and Mobile District inspectors performed quality assurance tests, such as filling the hopper with water (water test).

Hopper dredge data reports: The SI produces a series of dredge data summary reports, which provide

production and management information to help fulfill system requirements.

- The hopper trip report itemizes the times spent by the dredge performing each part of the dredging cycle. It documents dredging and disposal positions as well as start and stop times for each part of the dredging cycle. Documentation of non-dredging activities requires manual input and is included. Data on the amount of sediment dredged and/or transported is based on the Tons Dry Solids (TDS) of each hopper load. TDS is a measure of the dry mass of the hopper load. Given the weight and volume of the load, the dry (specific) density of the sediment, and the density of seawater at the dredging site, the dry mass of the load is computed. TDS is the best overall bin-measure method because of its accuracy and automation possibilities. One of the work units within the DOER program is titled Tons Dry Solids and is responsible for defining the best way to obtain this production measurement. Mobile District personnel are investigating the use of TDS as a pay basis to encourage maximum economic loads for their site conditions, which include fine material and long travel times.
- Daily and job reports are simply summaries of data collected over a 24-hour period. Job reports combine information from trip and daily reports with production and cost data, making the report useful for planning, budgeting, and cost estimating of future projects. The report also serves as a data source for bid abstract information.

Pipeline data reports: At the Mobile District's Tuscaloosa site office, the Corps dredge *Thompson* uses SI data acquisition standards for pipeline dredges. Currently, cutterhead horizontal and vertical positions are recorded. The *Thompson* can also acquire production meter data.

SI-generated quality assurance and quality control reports are based on District input and QA methods. Documentation was refined and improved. Routine inspector checks are being implemented as electronic forms. Existing QA and QC reports are being extended to incorporate information about routine inspector checks and contractor QC information about his instrumentation.

Conclusion

The SI design allows contractors to implement their own automation strategies and to comply only with standard reporting requirements. Corps Districts can leverage their existing investment in computer tools by adapting them to communicate with the SI. This process is now underway at the Mobile District.

The SI gives Corps dredging managers the capability to automate and improve existing inspection procedures. The availability of unbiased dredge data, and a means to manage it, will facilitate better documentation, innovative contract methods, and claim mitigation. The SI addresses project management, environmental surveillance, claims reduction, and standardized contractor requirements.

Additional information is available from James (Jay) Rosati, (601) 634-2022, e-mail: *j.rosati@cerc.wes.army.mil*.

Articles for Dredging Research requested

***Dredging Research* is an information exchange bulletin for publication of WES-generated dredging research results. Included are articles about applied research projects. The bulletin serves all audiences and is accessible on the World Wide Web in addition to a circulation of 2,800.**

Articles from non-WES authors are solicited for publication, especially if the work described is tied to the use of WES-generated research results. Research articles that complement WES research or cover wide field applications are also accepted for consideration. Manuscripts should include suggestions for visuals and a brief biography of the author and should use a nontechnical writing style. Point of contact is Elke Briuer, APR, at *briuere@mail.wes.army.mil*.

Sediment Quality Guidelines: An approach to dredged material management; Part 2, Terrestrial environments

edited by Elke Briuer, APR

Guidelines for the placement of materials on land may be useful in assessing dredged material placement. In the section of this article describing dredged material placement in the terrestrial environment, the various approaches are termed "quality guidelines (QG)," in contrast to SQGs, which are related to aquatic placement of dredged material.

USEPA 503 regulations, commonly known as the Part 503 rule (40 CFR Part 503), were published in the *Federal Register* on February 19, 1993. These QGs were developed for the application of sewage sludge to agricultural land for crop production. The maximum soil values for metals (arsenic, cadmium, chromium, copper, nickel, and zinc) were established through a risk assessment. This assessment involved selecting representative pathways by which humans, animals, and plants could become exposed to pollutants of concern that can be present in biosolids.

- U.S. Department of Agriculture guidance was developed in 1981 from the results of experimental data relating to toxic effects of metals on growth of various agricultural plants in various media (solution cultures, soil cultures, laboratory, greenhouse, and field tests). These QGs were developed for plant toxicity effects as related to metal concentrations of cadmium, copper, and zinc in the soil. Soil concentrations above the guidance levels were expected to result in plant toxicity.
- Oak Ridge National Laboratory soil values, developed 1997, were termed toxicological benchmarks for screening contaminants of concern for effects on terrestrial plants in ecological risk assessment. Values were derived from published literature and included both soil and solution experimental data. Methods for deriving soil benchmarks were based on the Long and Morgan (1990) method for deriving effects range low (ERL). The values were assumed to be conservative. When a benchmark was based on an LC_{50} or on some other end point that includes a 50-percent-or-greater reduction in survivorship, the value was divided by a factor of 5. This factor was based on the author's expert judgment that a factor of 5 approximates the ratio LC_{50}/EC_{20}.
- USACE Decisionmaking Framework, published in 1991, summarizes available guidance relating to contaminant levels in soils. Values were obtained from various guidelines available worldwide. The QG is based on the premise, "if there is concern for contaminants at these levels in soils, there might also be concern for contaminant concentrations at or above these levels in dredged material." A need for additional evaluation or testing may be indicated. Testing should follow the USACE/USEPA Technical Framework recommendations for the management of dredged material online at *http://www.wes.army.mil/el/dots/guidance.html*.

Limitations of QGs for terrestrial environments

Limitations are common to all QG methods. Assumptions always will result in some uncertainty. Major assumptions that limit the utility of all terrestrial guidelines include the following:

- The contaminant(s) in the dredged material being evaluated will act exactly the same as the contaminant(s) in the soil material from which the guideline was derived.
- Data collected for contaminant uptake by some plants will be applicable to all plants.
- Data collected for contaminant uptake by some animals will be applicable to other animals.

Appropriate uses for QGs in terrestrial environments

Generally, toxicity, bioaccumulation, plant and animal community alterations, etc., tend to increase as contaminant concentrations in the dredged material increase. However, the threshold and nature of this trend are unique to each dredged material and controlled by biogeochemical mechanisms at the disposal environment that are not well understood. Various guideline methods describe the general trend, but none can reliably identify individual dredged material as resulting in unacceptable adverse effects. Only case-specific, effects-based testing can determine that an individual dredged material will result in unacceptable adverse impacts to the environment in which it is placed.

Under very specific circumstances, these guidelines may be useful as screening values for early identification of dredged material of little environmental concern due to contaminants. QGs should not be used for any other purposes in dredged material evaluations.

Conclusions

SQGs and QGs have a place in dredged material assessments. They are useful as initial screening values in Tier 1 or 2 evaluations as part of the reason to believe that the material is or is not contaminated. If the guidelines or other available information indicate that there is "no reason to believe" contaminants are present, no additional chemical or toxicological evaluations at higher tiers would be necessary pursuant to the Ocean and Inland Testing Manuals online at *http://www.wes.army.mil/el/dots/guidance.html*. If there is a "reason to believe" the sediments are contaminated, toxicological evaluations at higher tiers would be necessary. Because of their inherent uncertainty as previously described, SQGs and QGs cannot be used deterministically in dredged material management decision-making.

Additional technical information is available from Dr. Robert M. Engler at (601) 634-3624 or Dr. C. R. Lee at (601) 634-3585. Questions on policy can be directed to Mr. Joseph R. Wilson at (202) 761-8846.

This article is Part 2 of a summary of Technical Note EEDP-04-29. Part 1 addressed SQGs in aquatic environments (see *http://www.wes.army.mil/el/dots/drieb.html*). EEDP-04-29 is online at *http://www.wes.army.mil/el/dots/pdfs/eed04-29. pdf*.

Innovative technologies workshop held in March

Fifteen members of the DOER Innovative Technologies Focus Area work group gathered March 10 and 11, 1999, in New Orleans. Work group members, representing Corps Districts and Divisions, attended the workshop to formulate an improved method for selecting and demonstrating innovative technologies.

Innovative technologies, in the context of DOER research, include innovations in contracting, in cost effective management techniques for operating dredging and disposal sites, and in new or refined uses of data and knowledge to aid in project decision making. This is in addition to hardware innovations such as improved dredges and pumps.

The following final recommendations for innovative technology research were made:

- Identify potential technologies currently used inside and outside of the Corps.
- Produce credible technology reviews that follow four screening criteria: 1. A project or program need identified by the field user community; 2. a positive benefit/cost relationship to the dredging program; 3. a high probability of field implementation; and 4. the availability of a demonstration project co-sponsor.
- Provide key technology findings to the DOER Field Review Group and the dredging managers throughout the Corps.
- Bring together the experienced and younger employees at the workshops and field review meetings to facilitate better communication, training, and dissemination of information and updates on innovative technologies.

Point of contact for additional information is Norman Francingues, 601-634-3703, *http://www.wes.army.mil/el/bios/francin.html*.

EPA/Corps Ocean Coordinators and Sediment Experts Meeting

by Billie H. Skinner, U.S. Army Engineer Waterways Experiment Station

The EPA/Corps Ocean Coordinators and Sediment Experts Meeting was held in Charleston during March 1-5, 1999. The meeting served to discuss technical and management issues related to inland and ocean disposal of dredged material as regulated by the Marine Protection, Research and Sanctuaries Act (MPRSA) and the Clean Water Act (CWA). Since publication of the Inland Testing Manual in Feb. 1998 and the Ocean Testing Manual in 1991, it is essential for the Corps and the EPA to work cooperatively to ensure that maintenance dredging responsibilities are carried out efficiently and within the budgets prescribed by Congress.

The agenda for the meeting included: Litigation Lessons, Testing and Evaluation Issues (Decision to Test; Sampling and Analysis Plan; Quality Assurance; Aspects of Evaluation; Methods for Risk- based Evaluation; Standardized Record Keeping/Documentation), Dredged Material Management, Budget and Policy Guidance Update, and a DOTS Web site demonstration.

The meeting was attended by personnel involved in implementing dredged material disposal regulations. Corps personnel represented headquarters, divisions, districts, and research facilities; EPA attendees represented ten EPA Regions.

Because of the complexity and sensitivity of the matter involved, it was determined that future meetings will be held at 1- to 2-year intervals.

Points of contact for additional information are: Dr. Robert M. Engler, (601) 634-3624; e-mail: *englerr@wes.army.mil*; or Mr. Joseph Wilson, (202) 761-8846; e-mail: *joseph.r.wilson@hq02.usace.army.mil.*

Dredging products recently placed online

New:

At *http://www.wes.army.mil/el/dots/research.html*, fact sheet:

- Center for Contaminated Sediments (CCS), with link to the ERED database.

At *http://www.wes.army.mil/el/dots/doer/reports.html*, technical reports:

- DOER-2, Environmental Risk Assessment and Dredged Material Management: Issues and Application (1.9 meg file size), December 1998
- DOER-3, Improving Dredged Material Management Decicions with Uncertainty Analysis (0.7 meg file size), December 1998

At *http://www.wes.army.mil/el/dots/doer/technote.html*, four technical notes:

- DOER-E2, Environmental Windows Associated with Dredging Operations, December 1998
- DOER-E3, Economic Impacts of Environmental Windows Associated with Dredging Operations, December 1998
- DOER-E4, FISHFATE: Population Dynamics Models to Assess Risks of Hydraulic Entrainment by Dredges, December 1998
- DOER-E5, Evaluation of Dredged Material Plumes Physical Monitoring Techniques, December 1998

Previously published products now online:

At *http://www.wes.army.mil/el/dots/research.html*, the Field Verification Program fact sheet now lists four technical reports:

- Technical Report D-89-2, Synthesis of the Results of the Field Verification Program Wetland Disposal Alternative
- Technical Report D-88-7, Synthesis of the Results of the Field Verification Porgram Upland Disposal Alternative
- Technical Report D-88-6, Summary of the US Army Corps of Engineers/US Environmental Protection Agency Field Verification Program
- Technical Report D-88-5, Synthesis of Research Results: Applicability and Field Verification of Predictive Methodologies for Aquatic Dredged Material Disposal

Calendar of Events

April 11-14 National Conference on Environmental Decision Making, sponsored by NOEDR, in Knoxville, TN.
POC: www.ncedr.org

April 12-14 Conference on Topics in Toxicology and Risk Assessment, Wright-Patterson AFB, Ohio
An interagency conference. Topics will include: Exposure Assessment Methods, Lead Biokinetic Modeling - Actual Model Use and Construction, Pollution Prevention, Issues in Neurobehavioral Endpoints in Risk Assessment, Reproductive Guidelines, Health and Environmental Risk Communication, Ecological Risk Assessment.
POC: Ms. Lois Doncaster, Conference Coordinator, phone: (937) 235-5293

April 26-30 US Geological Survey DODEC National Meeting, Tacoma, WA (Sheraton Hotel)
National meeting for all USGS/DOD environmental work. Brings together projects involving hydrology, geology, biology, and remote imagery. Natural attenuation, phytoremediation, geophysics, and modeling topics will be presented. Presentations and posters will be given on current USGS work at DOD installations across the US. DOD and regulatory personnel are encouraged to attend. Presentations on program and project results are also encourged. Contact John Powell at (703) 648-4169 if you need more information, would like to attend, or want to schedule a presentation.
POC: John Powell, USGS, (703) 648-4169, email: jdpowell@usgs.gov

April 26-30 Ninth International Zebra Mussel and Aquatic Nuisance Species Conference, hosted by the University of Minnesota Sea Grant Program, in Duluth, MN.
POC: Elizabeth Muckle-Jeffs, 800-868-8776 or www.zebraconf.org/

April 28-30 The 1999 Environmental Superconference
The Capitol Hilton, Washington, DC
The Superconference is aimed primarily at suppliers of environmental goods and services who want to explore opportunities for business with government and industry, and develop business/growth strategies. You can register at http://www.bpinews.com/super.html
POC: Voice: 800-589-5103, Fax: (301) 587-4530, bpiconferences@bpinews.com

May 2-5 A National Town Meeting, sponsored by President's Council on Sustainable Development and Global Environment & Technology Foundation, in Detroit, MI and other locations.
POC: N.M.@getf.org or www.sustainableamerica.org

May 10-14 WEFTEC Latin America '99 in conjunction with The 20th Brazilian Congress on Sanitary and Environmental Engineering, co-sponsored by Water Environment Federation (WEF) and Associacào Brasileira de Engenharia Sanitária e Ambiental (ABES), in Rio de Janeiro, Brazil.
POC: http://www.wef.org, e-mail: confinfo@wef.org, phone: (703) 684-2442.

May 12-14 U.S. Section International Navigation Association (PIANC) and Memphis and Shelby County Port Commission, Post of Memphis. Outlook for U.S. Ports and Waterways and Implications for the U.S. Transportation System.
POC: (703) 428-6286.

May 15-20 Western Dredging Association (WEDA) & Texas A&M University 31st Annual Dredging Seminar in Louisville, KY, Gault Hotel. WEDA XIX, "The Last Great Dredging Conference of the 20th Century," and Exhibition.
POC: http://jaws.tamu.edu/~oecds/or (360) 750-0209/(503) 285-5521.

May 17-18 Semi-Annual Meeting of the Great Lakes Commission, in Montreal, Quebec.
POC: Contact: Mike Donahue, (734) 665-9135, mdonahue@glc.org

May 19 40th Anniversary Celebration and Symposium on the Great Lakes-St. Lawrence Seaway System, in Montreal, Quebec.
POC: Mike Donahue, (734) 665-9135, mdonahue@glc.org

May 20-21 3th International Great Lakes-St. Lawrence Mayors' Conference, in Montreal, Quebec.
POC: Steve Thorp, (734) 665-9135, sthorp@glc.org

May 19-22 1999 Canadian Coastal Conference, in Victoria, BC.
POC: www.vgivision.com/CCC99

May 25-28 Annual Conference on Great Lakes Research, sponsored by IAGLR, in Cleveland, OH.
POC: www.iaglr.org

May 25-28 Current Issues in Great Lakes Benthic Science, sponsored by the North American Benthological Society, in Duluth, MN.
POC: Andy Casper, casperaf@clarkson.edu or www.benthos.org phone: (315) 268-3834

June 6-9 26th Annual ASCE Water Resources Planning and Management Conference,"Preparing for the 21st Century," in Tempe, Arizona,
POC: http://water99.asce.org

June 20-24 4th International Symposium on Coastal Engineering and Science of Coastal Sediment Processes, in Long Island, NY.
POC: http://www.coastalsediments.org/conference.htm

July 24-30 Coastal Zone '99, sponsored by NOAA, in San Diego, CA.
POC: cz99@umbsky.cc.umb.edu or http://omega.cc.umb.edu/~cz99/home.html

US Army Corps of Engineers

Dredging Research

This bulletin is published in accordance with AR 25-30 as an information dissemination function of the Environmental Laboratory of the Waterways Experiment Station. The publication is part of the technology transfer mission of the Dredging Operations Technical Support (DOTS) Program and includes information about various dredging research areas. Special emphasis will be placed on articles relating to application of research results or technology to specific project needs. The contents of this bulletin are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or the approval of the use of such commercial products. Contributions are solicited from all sources and will be considered for publication. Editor is Elke Briuer, APR, *briuere@wes.army.mil*. Mail correspondence to the Environmental Laboratory, ATTN: DOTS, *Dredging Research*, U.S. Army Engineer Waterways Experiment Station (CEWES-EP-D), 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, or call (601) 634-2349. Internet address: *www.wes.army.mil/el/dots.*

ROBIN R. CABABA
Colonel, Corps of Engineers
Acting Director

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DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MS 39180-6199